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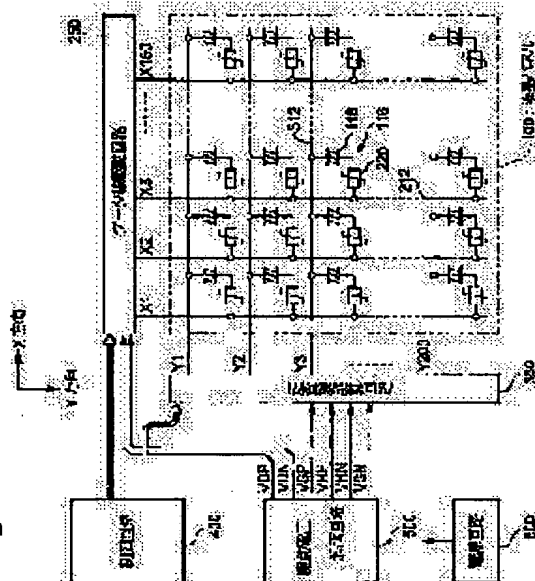
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**(54) MATRIX DISPLAY DEVICE AND DRIVING METHOD AND ELECTRONIC EQUIPMENT THEREFOR****(57)Abstract:**

**PROBLEM TO BE SOLVED:** To make low power consumption and high quality display compatible in a case of sector display.

**SOLUTION:** A scanning line driving circuit 350 supplies each of the scanning lines 312 belonging to a display area with a selection signal in a latter half period of one horizontal scanning period and a non-selection signal in the other period with the polarity inverted in each vertical scanning period, and on the other hand, it supplies each of the scanning lines 312 belonging to a non-selection area with the non-selection signal with the polarity inverted in each vertical scanning period with one or more non-selection signals. In a data line driving circuit 250, data signals inverted at a relatively short period are supplied to data lines 212 when the scanning lines 312 belonging to the first non-display area adjacent to the display area are selected, and on the other hand, data signals inverted at a relatively long period are supplied the data lines 212 when the scanning lines 312 belonging to the second non-display area adjacent to the first non-display area.

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[Claim(s)]

[Claim 1] It is the drive method of a matrix mold display of driving a pixel prepared corresponding to each crossover with two or more scanning lines and two or more data lines by switching element. While making into a display condition a viewing area which consists of a part of scanning lines among said two or more scanning lines the [ which consists of other scanning lines and adjoins said viewing area ] -- the [ 1 non-display field and / said ] -- the [ which adjoins 1 non-display field ], when making 2 non-display field into a non-display condition As opposed to each of the scanning line belonging to 2 non-display field the [ said ] -- the [ 1 non-display field and / said ] -- A non-selection signal which makes said switching element non-switch-on is inverted and supplied for every one or more vertical-scanning periods on the basis of a mean value of a signal supplied by said data line. the [ said ], when the scanning line belonging to 2 non-display field is chosen A data signal which consists of a positive side voltage level and a negative side voltage level on the basis of a mean value of signal amplitude to each of said data line criteria [ mean value / the ] -- carrying out -- the 1st period -- inverting -- supplying -- the [ said ], when the scanning line belonging to 1 non-display field is chosen A drive method of a matrix mold display characterized by inverting a data signal which consists of said positive side voltage level and said negative side voltage level the 2nd period shorter than said 1st period, and supplying it on the basis of the mean value to each of said data line.

[Claim 2] Said 2nd period is the drive method of a matrix mold display according to claim 1 characterized by being 1 horizontal-scanning period period.

[Claim 3] To each of the scanning line belonging to said viewing area, while divided 1 horizontal-scanning period and it is set at a period. In periods other than a selection signal which makes said switching element switch-on, and one [ said ] period A drive method of a matrix mold display according to claim 1 characterized by inverting and supplying a non-selection signal which presupposes un-flowing said switching element for every predetermined period on the basis of a mean value of a signal supplied by said data line.

[Claim 4] the [ said ] -- a polarity-reversals period of said positive side voltage level when the scanning line belonging to 2 non-display field is chosen, and said negative side voltage level -- the [ said ] -- a drive method of a matrix mold display according to claim 1 characterized by being a horizontal scanning period for \*\*\*\* which divided the number of scanning lines belonging to 2 non-display field by two or more integers.

[Claim 5] A matrix mold display which is characterized by providing the following and which drives a pixel prepared corresponding to each crossover with two or more scanning lines and two or more data lines by switching element While making into a display condition a viewing area which consists of a part of scanning lines among said two or more scanning lines the [ which consists of other scanning lines and adjoins said viewing area ] -- the [ 1 non-display field and / said ] -- the [ which adjoins 1 non-display field ], when making 2 non-display field into a non-display condition the [ said ] -- the [ 1 non-display field and / said ] -- a scanning-line drive circuit which inverts and supplies a non-selection signal which makes said switching element non-switch-on for every one or more vertical-scanning periods to each of the scanning line belonging to 2 non-display field on the basis of a mean value of a signal supplied by said data line the [ said ], when the scanning line belonging to 2 non-display field

is chosen A data signal which consists of a positive side voltage level and a negative side voltage level on the basis of a mean value of signal amplitude to each of said data line criteria [ mean value / the ] -- carrying out -- the 1st period -- inverting -- supplying -- the [ said ], when the scanning line belonging to 1 non-display field is chosen A data-line drive circuit which inverts a data signal which consists of said positive side voltage level and said negative side voltage level the 2nd period shorter than said 1st period, and supplies it on the basis of the mean value to each of said data line

[Claim 6] Said scanning-line drive circuit is a matrix mold display according to claim 5 characterized by reversing by turns the polarity of a non-selection signal supplied to the scanning line which adjoins each other on the basis of said mean value.

[Claim 7] When the scanning line which said data-line drive circuit is equipped with memory which has a field corresponding to said pixel, and belongs to said viewing area is chosen Read an indicative data from said memory and it is based on the indicative data concerned, while generating a signal which consists of said positive side voltage level and said negative side voltage level -- the [ said ] -- the [ 1 non-display field and / said ] -- a matrix mold display according to claim 5 characterized by stopping read-out from said memory when the scanning line belonging to 2 non-display field is chosen.

[Claim 8] Said switching element is a one terminal pair network mold switching element. Said matrix mold display It comes to pinch an opto electronics material between substrates of a pair. Said pixel Between two or more scanning lines formed in one substrate among substrates of said pair, and two or more data lines formed in a substrate of another side A matrix mold display given in claim 5 characterized by coming to carry out series connection of said one terminal pair network mold switching element and said opto electronics material thru/or any 1 term of 7.

[Claim 9] Said one terminal pair network mold switching element is a matrix mold display according to claim 8 characterized by having structure of the conductor / insulating material / conductor connected to either said scanning line or said data line.

[Claim 10] Electronic equipment characterized by having a matrix mold display according to claim 5.

#### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the drive method, the matrix mold display, and electronic equipment of the matrix mold display which suppressed generating of image quality deterioration and stopped power consumption very low.

[0002]

[Description of the Prior Art] The thing equipped with the element substrate with which two or more data lines with which a switching element is prepared in each of the pixel electrode arranged in the shape of a matrix, and to which both the ends of each switching element were connected were formed, the opposite substrate with which the scanning line, a color filter, etc. were formed, and the liquid crystal with which it filled up among both substrates is shown in the display panel of a matrix mold.

[0003] In such a configuration, if electric power is supplied in the voltage exceeding the threshold voltage of a switching element between the data line and the scanning line, using 2 terminal mold nonlinear devices, such as a thin-film diode (TFD:Thin Film Diode), as a switching element, a switching element will be in an ON state and a predetermined charge will be accumulated in a liquid crystal layer. And after a charge storage, by impressing the voltage which is less than threshold voltage, in a switching element, if resistance of a liquid crystal layer is fully high also as an OFF state, are recording of the charge in the liquid crystal layer concerned will be maintained. Thus, each switching element is driven, and if the amount of the charge to store up is controlled, the orientation condition of liquid crystal will change for every pixel, and it will become possible to display predetermined information. Under the present circumstances, since some periods are sufficient, the multiplexer drive which communalized the scanning line and the data line about two or more pixels is possible

for impressing the signal level used as an ON state to the liquid crystal layer for every pixel, and storing up a charge by choosing each scanning line as time sharing.

[0004] By the way, the number of display dots is increasing to the matrix mold display panel used for pocket mold electronic equipment like a cellular phone every year so that more information can be displayed. On the other hand, it is called for strongly that pocket mold electronic equipment is a low power since a cell drive is a principle. Therefore, such a matrix mold display panel is asked for the two properties of high-resolution-izing and low-power-izing which will carry out phase conflict if it glances. Then, while zooming to full screen when high resolution is required in order to solve this, when other, the attempt of low-power-izing by the partial drive method of a screen which is made to display only a field in part and makes other fields a non-display condition is made.

[0005] Drawing 14 is a timing chart which shows the drive wave of the display panel in the conventional partial drive method. In this example, while the total of the scanning line makes a viewing area the field from those with 220, and the 101st scanning line to the 120th scanning line, the field from the 1st scanning line to the 100th scanning line and the field from the 121st scanning line to the 220th scanning line are made into the non-display field. Moreover, a display panel shall operate by the normally white mode, and shall display black on a viewing area.

[0006] The scan signal Y101 supplied to the 101st scanning line takes selection voltage (this example VSP) in that second half in the 101st horizontal scanning period. In addition, selection voltage (VSP or VSN) is taken in the second half of each horizontal scanning period like the scan signal Y101 about other scan signals corresponding to a viewing area. On the other hand, non-choosing voltage (VHP or VHN) is always supplied to the scanning line corresponding to a non-display field.

[0007] Moreover, data signal X supplied to a certain data line serves as the usual signal wave form in the period corresponding to a viewing area, while the count of reversal serves as few signal wave forms where a period is long, in the period corresponding to a non-display field, as shown in drawing.

[0008] It becomes possible to display an image only by the viewing area and not to display an image in a non-display field by this. And therefore, power consumption is reducible for not writing a charge in a liquid crystal layer in a non-display field the 1st, and having lengthened the reversal period of data signal X in the period corresponding to a non-display field the 2nd.

[0009]

[Problem(s) to be Solved by the Invention] By the way, actual-value wave X' of data signal X is sharply changed in response to the effect of the low-frequency component of the period concerned in a non-display period, as shown in drawing 14. On the other hand, actual-value wave X' immediately after initiation of a display period is influenced of a non-display period, and comes to converge it on a mean value after that. That is, immediately after initiation of a display period, and just before termination, the actual value of data signal X supplied to the data line will differ.

[0010] On the other hand, since it changes according to the actual value of the voltage on which the permeability of a liquid crystal layer is \*\*\*\*(ed) there, if the actual value of data signal X changes, display gradation will change in response to the effect. Therefore, immediately after initiation of a display period, and just before termination, the gradation which it is going to display the same gradation and is actually displayed is different, and there is a problem that image quality will deteriorate.

[0011] This invention was made in view of such a problem, and the place made into that purpose is to offer the electronic equipment which equipped with this display low-power-izing, still the drive method of a matrix mold display that can attain simplification of a configuration and the matrix mold display equipped with this drive circuit, and the list after suppressing generating of image quality deterioration.

[0012]

[Means for Solving the Problem] If it is in a drive method of a matrix mold display concerning this invention in order to attain the above-mentioned purpose It is what drives a pixel

prepared corresponding to each crossover with two or more scanning lines and two or more data lines by switching element. While making into a display condition a viewing area which consists of a part of scanning lines among said two or more scanning lines the [ which consists of other scanning lines and adjoins said viewing area ] -- the [ 1 non-display field and / said ] -- the [ which adjoins 1 non-display field ], when making 2 non-display field into a non-display condition As opposed to each of the scanning line belonging to 2 non-display field the [ said ] -- the [ 1 non-display field and / said ] -- A non-selection signal which makes said switching element non-switch-on is inverted and supplied for every one or more vertical-scanning periods on the basis of a mean value of a signal supplied by said data line. the [ said ], when the scanning line belonging to 2 non-display field is chosen A data signal which consists of a positive side voltage level and a negative side voltage level on the basis of a mean value of signal amplitude to each of said data line criteria [ mean value / the ] -- carrying out -- the 1st period -- inverting -- supplying -- the [ said ], when the scanning line belonging to 1 non-display field is chosen It is characterized by inverting a data signal which consists of said positive side voltage level and said negative side voltage level the 2nd period shorter than said 1st period, and supplying it on the basis of the mean value, to each of said data line.

[0013] according to this invention -- the -- since a data signal reversed a short period is supplied when the scanning line of 1 non-display field is chosen -- the -- when choosing the scanning line of 2 non-display field, even if it supplies a data signal of a long period, when choosing the scanning line of a viewing area, an actual-value wave of a data signal can be completed as intermediate voltage level of a positive side voltage level and a negative side voltage level. Therefore, it can oppress that an image of a viewing area carries out image quality deterioration in response to effect of a non-display field. In addition, as for the 2nd period, it is desirable that it is 1 horizontal-scanning period period.

[0014] Moreover, if only a viewpoint of stopping power consumption low is taken into consideration, it will be thought to each of the scanning line belonging to a non-display field that a configuration which supplies a signal equivalent to a mean value of a signal supplied to the data line is desirable. However, with this configuration, since it is necessary to choose separately a signal of voltage which is equivalent to a mean value in a circuit which drives the scanning line further since it is necessary to generate voltage equivalent to a mean value separately, a configuration of a voltage formation circuit or a scanning-line drive circuit is complicated. on the other hand -- according to this invention -- the -- the [ 1 non-display field and ] -- since a non-selection signal is reversed and is supplied for every one or more vertical-scanning periods on the basis of a mean value to each of the scanning line belonging to 2 non-display field, it is not necessary to generate a signal of voltage equivalent to a mean value, and to choose For this reason, a configuration is simplified. Furthermore, since a voltage level is switched for every one or more vertical-scanning periods and every more desirable period longer than 1 vertical-scanning period, frequency of a signal supplied to the scanning line concerned also falls. For this reason, while power consumption accompanying voltage switch actuation is held down in a circuit which drives the scanning line, power consumed because capacity which accompanies the scanning line and a drive circuit carries out charge and discharge by voltage switch is also stopped.

[0015] Moreover, in this invention, it is desirable to invert and supply a selection signal which makes said switching element switch-on in a period while 1 horizontal-scanning period was divided, and a non-selection signal which presupposes un-flowing said switching element in periods other than one [ said ] period for every predetermined period to each of the scanning line belonging to said viewing area on the basis of a mean value of a signal supplied by said data line. According to this configuration, a signal supplied to each of the scanning line belonging to a viewing area does not change at all compared with the usual condition which makes all the scanning lines a viewing area. For this reason, while complication of a configuration accompanying making a duty ratio change is avoided, display grace of a viewing area does not fall compared with the usual condition.

[0016] furthermore, this invention -- setting -- the [ said ] -- a polarity-reversals period of said positive side voltage level when the scanning line belonging to 2 non-display field is chosen,

and said negative side voltage level -- the [ said ] -- it is desirable that it is a horizontal scanning period for \*\*\*\* which divided the number of scanning lines belonging to 2 non-display field by two or more integers. thus -- if it carries out -- the -- a period when a signal of a positive side voltage level is supplied when the scanning line belonging to 2 non-display field is chosen, and a period when a signal of negative side level is supplied -- mutual -- etc. -- it spreads -- it becomes. the -- if it is a horizontal scanning period for a quotient which divided the number of scanning lines belonging to 2 non-display field by 2, since a polarity-reversals period will serve as the longest, power consumed with switch actuation of voltage, power consumed because capacity which accompanies a circuit and wiring with a voltage switch carries out charge and discharge will be stopped most.

[0017] Next, if shown in a matrix mold display concerning this invention It is what drives a pixel prepared corresponding to each crossover with two or more scanning lines and two or more data lines by switching element. While making into a display condition a viewing area which consists of a part of scanning lines among said two or more scanning lines the [ which consists of other scanning lines and adjoins said viewing area ] -- the [ 1 non-display field and / said ] -- the [ which adjoins 1 non-display field ], when making 2 non-display field into a non-display condition As opposed to each of the scanning line belonging to 2 non-display field the [ said ] -- the [ 1 non-display field and / said ] -- A scanning-line drive circuit which inverts and supplies a non-selection signal which makes said switching element non-switch-on for every one or more vertical-scanning periods on the basis of a mean value of a signal supplied by said data line, the [ said ], when the scanning line belonging to 2 non-display field is chosen A data signal which consists of a positive side voltage level and a negative side voltage level on the basis of a mean value of signal amplitude to each of said data line criteria [ mean value / the ] -- carrying out -- the 1st period -- inverting -- supplying -- the [ said ], when the scanning line belonging to 1 non-display field is chosen It is characterized by having a data-line drive circuit which inverts a data signal which consists of said positive side voltage level and said negative side voltage level the 2nd period shorter than said 1st period, and supplies it on the basis of the mean value to each of said data line.

[0018] In this invention, an effect which was mentioned above can be done so on both sides by the side of the scanning line and the data line. Therefore, further, this synergistic effect enables it to attain high-resolution-izing and simplification of a configuration, after suppressing generating of image quality deterioration, still much more low-power-izing and. Here, as for said scanning-line drive circuit, in this invention, it is desirable to reverse by turns the polarity of a selection signal supplied to the scanning line which adjoins each other on the basis of said mean value. Although the current-voltage characteristics of a switching element which drives a pixel may differ a little by case where voltage by the side of a case where voltage by the side of straight polarity is impressed, and negative polarity is impressed and applied voltage to a pixel may differ While the polarity of selection voltage supplied in the adjoining scanning line is reversed according to this invention, since the polarity of a data signal is also equivalent to the polarity of a selection signal, applied voltage to a pixel located in the even-numbered scanning line and a pixel located in the odd-numbered scanning line will invert it by turns. For this reason, display unevenness of that pixel is not conspicuous, and since polarity-reversals drive frequency is high, a flicker is not conspicuous, either.

[0019] In this invention moreover, said data-line drive circuit When the scanning line which is equipped with memory which has a field corresponding to said pixel, and belongs to said viewing area is chosen Read an indicative data from said memory and it is based on the indicative data concerned. while generating a signal which consists of said positive side voltage level and said negative side voltage level -- the [ said ] -- the [ 1 non-display field and / said ] -- when the scanning line belonging to 2 non-display field is chosen, it is desirable to stop read-out from said memory. this configuration -- setting -- the [ said ] -- the [ 1 non-display field and / said ] -- a case where the scanning line belonging to 2 non-display field is chosen is a case where it is not necessary to display. Further low-power-ization will be attained as a result of stopping [ according to this invention ] power consumption in connection with this in such a case, since read-out of memory is stopped.

[0020] Moreover, in this invention, said switching element is a one terminal pair network mold switching element, it comes to pinch an opto electronics material between substrates of a pair, and, as for said pixel, it is desirable [ as for said matrix mold display ] to come to carry out series connection of said one terminal pair network mold switching element and said opto electronics material between two or more scanning lines formed in one substrate among substrates of said pair and two or more data lines formed in a substrate of another side. In this invention, although it is also possible to use 3 terminal molds like a transistor as a switching element, since the scanning line and the data line are made to cross and it is necessary to form, in one substrate, difficulty is in a point that the possibility of wiring short-circuit becomes high. Moreover, a manufacture process is also complicated. On the other hand, if a one terminal pair network mold is used, since the scanning line will be formed in one substrate and the data line will be formed in a substrate of another side, wiring short-circuit is advantageous at a point which is not generated theoretically. Moreover, a manufacture process is also simplified compared with a case where 3 terminal molds are used.

[0021] Furthermore, as for said one terminal pair network mold switching element, in this invention, it is desirable to have structure of the conductor / insulating material / conductor connected to either said scanning line or said data line. Among these, since it is formed because a conductor of the 1st layer can be used as the scanning line or the data line as it is and an insulating material anodizes this conductor of the 1st layer, simplification of a manufacture process will be attained still further.

[0022] If it is in electronic equipment concerning this invention in order to add and to attain the above-mentioned purpose, it is characterized by having the above-mentioned matrix mold display. Therefore, after suppressing generating of image quality deterioration in a display as mentioned above if it was in this electronic equipment, it becomes still more possible high-resolution-izing, much more low-power-ization, and to attain simplification of a configuration.

[0023]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

The electric configuration of the display concerning the operation gestalt of this invention is explained at the beginning of a <electric configuration>. Drawing 1 is the block diagram showing this electric configuration. As shown in this drawing, while two or more data lines (segment electrode) 212 are extended and formed in the direction of a train (Y) and two or more scanning lines (common electrode) 312 are extended and formed in the direction of a line (X), the pixel 116 is formed in the liquid crystal panel 100 corresponding to each intersection of the data line 212 and the scanning line 312. Furthermore, each pixel 116 consists of series connection of an opto electronics material (liquid crystal layer) 118 and a one terminal pair network mold switching element (henceforth TFD) 220 like TFD (Thin Film Diode) which is an example of a switching element. Here, if it is in this operation gestalt, although the total of the scanning line 312 is made into 200, and the total of the data line 212 is made into 160 for convenience and explained as a matrix mold display of 200 line x160 train, it is not the meaning of explanation which limits this invention to this. Moreover, the data-line drive circuit 250 supplies data signals X1-X160 to each data line 212, respectively, and the scanning-line drive circuit 350 supplies the scan signals Y1-Y200 to each scanning line 312, respectively.

[0024] In addition, in drawing 1, although TFD220 is connected to a data-line 212 side and the liquid crystal layer 118 is connected to the scanning-line 312 side, the configuration that TFD220 is connected to a scanning-line 312 side, and the liquid crystal layer 118 is connected to reverse at a data-line 212 side, respectively is sufficient as this.

[0025] Next, a control circuit 400 supplies various control signals, a clock signal, etc. which are mentioned later to the data-line drive circuit 250 and the scanning-line drive circuit 350. In addition, suppose that it mentions later also with the details of the data-line drive circuit 250, the scanning-line drive circuit 350, and a control circuit 400.

[0026] Moreover, the driver voltage formation circuit 500 generates the voltage levels VDP



and VDN used as a data signal, and the voltage levels VSP, VHP, VHN, and VSN used as a scan signal, respectively. In addition, although voltage levels VDP and VHP are shared as the same level and voltage levels VDN and VHN are similarly shared on the same level, if it is in this operation gestalt, these voltage levels are made into the thing of explanation to explain as a separate notation for convenience. And a power circuit 600 supplies a power supply to a control circuit 400 or the driver voltage formation circuit 500.

[0027] A <panel configuration>, next the details configuration of a liquid crystal panel 100 are explained. Drawing 2 is the partial fracture perspective diagram showing the structure. As shown in this drawing, the liquid crystal panel 100 is equipped with the element substrate 200 and the opposite substrate 300 by which opposite arrangement is carried out at this. Among these, 200 pixel electrodes 234 which the pixel electrode 234 which becomes the opposed face of the element substrate 200 from transparency conductors, such as ITO (Indium Tin Oxide), has arranged in the shape of a matrix in the direction of X and the direction of Y, among these are arranged in the same train are connected to one of the data lines 212 which extend in the direction of Y through TFD220, respectively. Here, in view of a substrate side, TFD220 is formed from a tantalum simple substance, a tantalum alloy, etc., consists of the 1st conductor 222 which branched in the data line 212, an insulating material 224 which comes to anodize this 1st conductor 222, and the 2nd conductor 226, such as chromium \*\*, and takes the sandwich structure of a conductor / insulating material / conductor. For this reason, TFD220 will have the diode switching characteristic from which the current-voltage characteristic becomes nonlinear over positive/negative both directions.

[0028] Moreover, the reason an insulating material 201 has transparency and insulation, and this is prepared is for making it an impurity not spread in the 1st conductor 222 by heat treatment after deposition of the 2nd conductor 226, in order to make it the 1st conductor 222 not exfoliate. Therefore, when these do not pose a problem, an insulating material 201 can be omitted.

[0029] It is formed so that the scanning line 312 may extend in the direction of X and the opposed face of the opposite substrate 300 may be countered with the pixel electrode 234 on the other hand. And the element substrate 200 and the opposite substrate 300 which were constituted in this way are maintaining the fixed gap with the sealant and the spacer (both illustration abbreviation), as an opto electronics material, the liquid crystal 105 of TN (Twisted Nematic) mold will be enclosed, and the liquid crystal layer 118 in drawing 1 will be formed in this closed space by this. That is, the liquid crystal layer 118 will consist of the scanning line 312 concerned, a pixel electrode 234, and liquid crystal 105 pinched by inter-electrode [ of both ] on the intersection of the data line 212 and the scanning line 312.

[0030] Therefore, in such a configuration, if selection voltage is impressed as a scan signal through the scanning line 312, the TFD concerned will be in switch-on. If a data signal is impressed through the data line 212 in the case of this switch-on, a predetermined charge will be accumulated in the liquid crystal layer connected to the TFD concerned. Non-choosing voltage is impressed after a charge storage, and in the TFD concerned, if there is little leak (off leak) concerned of TFD also as non-switch-on and resistance of a liquid crystal layer is fully high, are recording of the charge in the liquid crystal layer concerned will be maintained. Thus, it is possible for the orientation condition of liquid crystal to change for every pixel, and to display predetermined information by controlling the amount of each charge in which TFD is driven and stored up.

[0031] Otherwise, the color filter arranged the shape of a stripe, the shape of the shape of a mosaic and a triangle, etc. is prepared in the opposite substrate 300, corresponding to the use of a liquid crystal panel 100, and the black matrix which consists of a metallic material, resin, etc. is further prepared in it. It adds, and while the orientation film by which rubbing processing was carried out is prepared in the predetermined direction, respectively, the polarizing plate according to the direction of orientation is prepared in each of that back at each opposed face of the element substrate 200 and the opposite substrate 300, respectively (all are illustration abbreviations).

[0032] However, in a liquid crystal panel 100, if the polymer dispersed liquid crystal which

distributed liquid crystal as a minute grain in the macromolecule is used, since an above-mentioned orientation film, an above-mentioned polarizing plate, etc. will become unnecessary, efficiency for light utilization increases and, for this reason, it is advantageous in points, such as a raise in the brightness of a liquid crystal panel, and low-power-izing. Moreover, when using a liquid crystal panel 100 as a reflective mold, the pixel electrode 234 may be constituted from a metal membrane with high reflection factors, such as aluminum, etc., and the element substrate 200 may consist of opaque semiconductor substrates.

[0033] In addition, TFD220 is an example of a one terminal pair network mold switching element, and may use a ZnO (zinc oxide) varistor and elements, such as MSI (Metal Semi-Insulator), for others as a one terminal pair network mold switching element. moreover, these elements -- 2 reverse sense -- series connection -- or parallel connection may be carried out. When it carries out like this, there is also an advantage that a diode switching characteristic is symmetrized over positive/negative both directions.

[0034] The details configuration of a <control circuit>, next a control circuit 400 is explained. Drawing 3 is the block diagram showing the configuration of a control circuit 400. In drawing, the RF oscillator circuit 4006 generates the RF pulse signal used as a \*\*\*\* signal of the gradation code pulse GCP mentioned later. For this reason, the frequency of a RF pulse signal is higher than the low frequency pulse signal which specifies 1 / 2 horizontal-scanning period for whether your being Haruka, and is about 3MHz. Moreover, a frequency divider 4004 carries out dividing of the RF pulse signal outputted from the RF oscillator circuit 4006, and generates the low frequency pulse signal used as the criteria of a horizontal scanning. Here, if it is in this operation gestalt, since it has the composition of driving by dividing 1 horizontal-scanning period during the first half and in the second half, this low frequency pulse signal is used in order to specify 1 / 2 horizontal-scanning period. For this reason, the frequency of a low frequency pulse signal is about 30kHz. The control signal generation circuit 4002 generates various control signals, clock signals (PD1, PD2, YD, YCLK, MY, INH, LP, MX, RES, SP, etc.), etc. based on the low frequency panel signal outputted from the frequency divider 4004.

[0035] The gradation control signal generation circuit 4008 makes the RF pulse signal by the RF oscillator circuit 4006 arrange here according to the wait of the indicative data which shows gradation in 1 / 2 horizontal-scanning period specified by the low frequency pulse signal by the frequency divider 4004, and the gradation code pulse (gradation control signal) GCP as shown in drawing 10 is generated. In addition, in drawing 10, although the gradation code pulse GCP is arranged in the pitches for the facilities of explanation etc., it may serve as a different pitch in fact.

[0036] Now, the control signal generation circuit 4002 generates following various control signals, clock signals, etc. according to the low frequency pulse signal by the frequency divider 4004. When making the part I part display-control signal PD 1 into a non-display field the 1st about the field where only the field included in a certain scanning line 312 is included in the other scanning line 312 as a display condition (in the case of sector display), only the period when the scanning line 312 contained in a viewing area is chosen is the signal which serves as H level and serves as L level in the other period. Only the period when the scanning line 312 contained by the 2nd to the fixed field to which the part II part display-control signal PD 2 adjoins a viewing area among non-display fields is chosen is the signal which serves as H level and serves as L level in the other period.

[0037] It is the pulse outputted at the beginning of 1 vertical-scanning period (one frame) the 3rd as the initiation pulse YD is shown at drawing 5. In the 4th, clock signal YCLK is a reference signal by the side of the scanning line, and as shown at drawing 5, it has the period of 1H which correspond at 1 horizontal-scanning period. To the 5th, the alternating current driving signal MY is a signal used in order to carry out the alternating current drive of the liquid crystal pixel at a scanning-line side, and as shown at drawing 5, in the horizontal scanning period when signal level is reversed to every 1 horizontal-scanning period 1H at, and the same scanning line is chosen, signal level reverses it for every frame. For this reason, the drive which the polarity of the applied voltage to a liquid crystal pixel reverses for every 1

horizontal-scanning period with the alternating current driving signal MY, and that polarity reverses for every 1 vertical-scanning period will be controlled.

[0038] a control signal INH is a signal for choosing between the second half of 1 horizontal-scanning period, and is shown in the 6th at drawing 5 -- as -- between the second half concerned -- H -- it becomes active. The latch pulse LP is for latching a data signal at a data-line side, and as shown at drawing 10, it is outputted to the 7th at the beginning of 1 horizontal-scanning period. Reset-signal RES is a pulse for specifying between the first half of 1 horizontal-scanning period, and between the second half at a data-line side, and as shown at drawing 10, it is outputted to the 8th at the beginning of during the first half and a between [ the second half ]. As it is the signal used in order that the alternating current driving signal MX may carry out the alternating current drive of the liquid crystal pixel at a data-line side and is shown in the 9th at drawing 10, it is the signal which maintains this level and carries out level reversal after that in the first half of following horizontal scanning period 1H from between a certain second half of horizontal scanning period 1H. In addition, the alternating current driving signal MX during the second half of 1 horizontal-scanning period and the alternating current driving signal MY during a synchronization are set up so that it may be mutually set to reversal level.

[0039] Moreover, the control signal generation circuit 4002 performs control which stops generation of the gradation code pulse GCP to the gradation control signal generation circuit 4008, when making the part I part display-control signal PD 1 into L level. In addition, it is good also as a configuration which transposes a frequency divider 4004 to a low frequency oscillator circuit, and is equipped with two oscillator circuits with the RF oscillator circuit 4006.

[0040] The details of a <scanning-line drive circuit>, next the scanning-line drive circuit 350 are explained. Drawing 4 is the block diagram showing the configuration of this scanning-line drive circuit 350. In this drawing, a shift register 3502 is a 200 bit-shift register corresponding to a scanning-line number, carries out a sequential shift according to clock signal YCLK which has the period of 1 horizontal-scanning period, and outputs the initiation pulse YD supplied to the beginning of one frame as transfer signals YS1, YS2, ..., YS200. Here, the transfer signals YS1-YS200 specify which scanning line 312 should be chosen as each scanning line corresponding to 1 to 1, respectively.

[0041] Then, the voltage selection signal formation circuit 3504 outputs the voltage selection signal which defines the voltage which should be impressed to each scanning line 312 from the alternating current driving signal MY and a control signal INH. The period when VSP or VSN which the voltage of the scan signal impressed to the scanning line 312 contained in a viewing area in this operation gestalt here is four values of VSP (positive side selection voltage), VHP (\*\*\*\*\* selection voltage), VHN (negative side non-choosing voltage), and VSN (negative side selection voltage), among these is selection voltage is actually impressed is during the second half of 1 horizontal-scanning period. Furthermore, the non-choosing voltage impressed after selection voltage is impressed is VHP if selection voltage is VSP, if selection voltage is VSN, is VHN and has become settled uniquely with the selection voltage concerned. Moreover, the intermediate voltage of VSP and VSN and the intermediate voltage of VHP and VHN are in agreement with reference voltage VR. It adds and this reference voltage VR is in agreement with the positive side data voltage VDP of the data signal mentioned later, and the intermediate voltage of the negative side data voltage VDN.

[0042] When the part I part display-control signal PD 1 is H level, the voltage selection signal formation circuit 3504 generates a voltage selection signal so that the voltage level of a scan signal may serve as the following relation. Namely, if the transfer signal corresponding to a certain scanning line is set to H level and the scanning line concerned is chosen as the 1st So that it may consider as the selection voltage according to the alternating current driving signal MY in the period (between the second half of 1 horizontal-scanning period) when a control signal INH serves as H level and a control signal INH may serve as non-choosing voltage corresponding to the selection voltage concerned after changing on L level the 2nd The voltage selection signal formation circuit 3504 generates a voltage selection signal.

Specifically the voltage selection signal formation circuit 3504 The voltage selection signal as which the positive side selection voltage VSP will be made to choose it in the period which becomes active if the alternating current driving signal MY is H level is outputted to the period concerned. a control signal INH -- H -- Then, while outputting the voltage selection signal as which the \*\*\*\*\* selection voltage VHP is made to choose it, if the alternating current driving signal MY is L level, the voltage selection signal as which the negative side selection voltage VSN is made to choose it will be outputted to the period concerned, and the voltage selection signal as which the negative side non-choosing voltage VHN is made to choose it will be outputted after this.

[0043] In addition, in the operation gestalt of this invention, on the basis of the middle potential of the signal impressed to the data line, a high potential side is made positive and negative [ of the potential impressed to the scanning line or the data line / positive (straight polarity) and negative (negative polarity) ] make the low voltage side negative.

[0044] The voltage of the scan signal impressed to the scanning line 312 contained to a non-display field in this operation gestalt on the other hand is binary [ of VHP and VHN ]. For this reason, when the part I part display-control signal PD 1 is L level, the voltage selection signal formation circuit 3504 generates a voltage selection signal so that the voltage level of a scan signal may serve as the following relation. namely, -- if a control signal INH serves as H level and between the second half of 1 horizontal-scanning period is chosen, while the transfer signal corresponding to a certain scanning line is set to H level and the scanning line concerned is chosen as the 1st -- another side from one side of the \*\*\*\*\* selection voltage VHP, and the negative side non-choosing voltage VHN -- the voltage selection signal formation circuit 3504 generates a voltage selection signal so that it may be reversed.

[0045] Now, a level shifter 3506 expands the voltage swing of the voltage selection signal outputted by the voltage selection signal formation circuit 3504. And a selector 3508 actually chooses the voltage directed by the voltage selection signal to which the voltage swing was expanded, and supplies it to each of the corresponding scanning line 312.

[0046] <The voltage waveform of a scan signal>, next the voltage waveform of the scan signal supplied by the scanning-line drive circuit 350 of the above-mentioned configuration are examined. First, for convenience, when [ of explanation ] performing a full screen display, the case where the part I part display-control signal PD 1 is always H level is assumed. In this case, the voltage waveform of a scan signal becomes as it is shown in drawing 5 . Namely, while the sequential shift of the initiation pulse YD is carried out by clock signal YCLK at every 1 horizontal-scanning period 1H and this is outputted as transfer signals YS1-YS200 Since between the second half of 1 horizontal-scanning period 1H is chosen by the control signal INH and the selection voltage of a scan signal is further defined according to the level of the alternating current driving signal MY during the second half concerned In the second half of the horizontal scanning period when the scanning line concerned is chosen, if it is H level, it will become the positive side selection voltage VSP, and as for the voltage of the scan signal supplied to the one scanning line, the alternating current driving signal MY holds the \*\*\*\*\* selection voltage VHP corresponding to the selection voltage concerned after that. And since one frame passes, the level of the alternating current driving signal MY is reversed in the second half of 1 horizontal-scanning period and it is set to L level, the voltage of the scan signal supplied to the scanning line concerned turns into the negative side selection voltage VSN, and the negative side non-choosing voltage VHN corresponding to the selection voltage concerned will be held after that. As shown in drawing 5 , for example, the voltage of the scan signal Y1 of the scanning line first chosen in the n-th certain frame Become the positive side selection voltage VSP in the second half of the horizontal scanning period concerned, and after that, hold the non-choosing voltage VHP and it sets on the following \*\* (n+1) frame. It becomes the negative side selection voltage VSN in the second half of the first 1 horizontal-scanning period, and becomes the repeat of the cycle of holding the negative side non-choosing voltage VHP after that.

[0047] On the other hand, since signal level reverses the alternating current driving signal MY to every 1 horizontal-scanning period 1H, the voltage of the scan signal supplied to the

adjoining scanning line also serves as relation which polarity reverses by turns to every 1 horizontal-scanning period 1H. For example, as shown in drawing 5, if the voltage of the scan signal Y1 to the scanning line first chosen in the n-th certain frame is the positive side selection voltage VSP in the second half of the horizontal scanning period concerned, the voltage of the scan signal Y2 to the scanning line chosen as the 2nd will turn into the negative side selection voltage VSN in the second half of the horizontal scanning period concerned.

[0048] Next, the scan signal in the case of performing sector display is examined. Here, while making into a non-display field the pixel field scanned as an example by the scanning line of sector display as shown in drawing 6, the pixel field which counts from a top and is specifically scanned by one to 80 Motome's scanning line in a liquid crystal panel 100, and 121 to 200 Motome, respectively, it assumes about the case where sector display which makes a viewing area the pixel field scanned by 81 to 121 Motome's scanning line is performed.

[0049] The point that in the case of sector display the sequential shift of the initiation pulse YD is carried out by clock signal YCLK at every 1 horizontal-scanning period 1H, and this is outputted as transfer signals YS1-YS200 is the same as that of the case of a full screen display. As the part I part display-control signal PD 1 is shown in drawing 7, however, the inside of 1 vertical-scanning period, Since it is set to L level in 121 to 200 Motomè, and a total of 160 horizontal scanning period when one to 80 Motome's scanning line is chosen in the following frame In the 180 horizontal-scanning period concerned, while the transfer signals YS1-YS80 corresponding to the scanning line concerned, and YS121-YS200 change on H level When a control signal INH serves as H level, each voltage level of the scan signal supplied to the scanning line of one to 80 Motome and 121 to 200 Motome will be changed from VHN from the non-choosing voltage VHP, or the non-choosing voltage VHN to VHP.

[0050] On the other hand, in the 40 horizontal-scanning period concerned, since the part I part display-control signal PD 1 serves as H level in a total of 40 horizontal scanning period when 81 to 120 Motome's scanning line is chosen among 1 vertical-scanning periods, if it says only within the scan signal supplied to 81 to 120 Motome's scanning line, it will become being the same as that of the case of a full screen display.

[0051] Therefore, the scan signal in the case of performing sector display as shown in drawing 6, and especially the scan signal supplied to the scanning line near the boundary of a non-display field and a viewing area become as it is shown in drawing 7. Namely, in the middle of the horizontal scanning period of the corresponding scanning line, the scan signals Y1-Y80 to one to non-display field slack 80 Motome's scanning line and 121 to 200 Motome's scanning line, and Y121-Y200 are changed from one side of the non-choosing voltage VHP and VHN to another side, respectively. For this reason, if it is in this operation gestalt, as for the scan signal to a non-display field, the polarity of non-choosing voltage will be reversed for every frame.

[0052] If it says only from a viewpoint of attaining low-power-ization here, the scan signal to a non-display field Although the configuration made into the intermediate voltage of the voltage VDP and VDN impressed as a data signal is desirable, with this configuration The driver voltage formation circuit 500 (refer to drawing 1) not only needs to form special intermediate voltage, but Since the number of bits is too many needed also in the voltage selection signal by the voltage selection signal formation circuit 3504 (refer to drawing 4) and the selection range of a selector 3508 spreads further, a configuration is complicated. On the other hand, since the configuration itself is as practically equal as the conventional configuration which performs only a full screen display according to this operation gestalt, complication of a configuration is prevented. It becomes possible about the intermediate voltage of a data signal to stop low as much as [ to supply ] a configuration in the power consumed by the scanning-line drive circuit 350 when performing sector display, since it is only generated by switching low voltage moreover called non-choosing voltage in the scan signal to a non-choosing field at a very long gap called 1V equivalent to one frame.

[0053] In addition, although the switching gap of non-choosing voltage was a period of 1V equivalent to one frame with this operation gestalt, the power consumption accompanying switching in the direction made into a gap longer than it is held down. For this reason, as

shown in drawing 8 , the switching gap of non-choosing voltage may be good also as 2V equivalent to two frames, and the period beyond it is sufficient as it. However, it is not desirable in the display on condition of an alternating current drive to fix the scan signal to a non-display field to one side of the non-choosing voltage VHP and VHN.

[0054] On the other hand, they serve as a repeat of the cycle of becoming the selection voltage of another side in the second half of the horizontal scanning period after one-frame progress, and becoming the non-choosing voltage corresponding to the selection voltage after that while they are held at the non-choosing voltage corresponding to the selection voltage, after the scan signals Y81-Y120 to 81 to viewing-area slack 120 Motome's scanning line serve as one side of the selection voltage VSP or VSN in the second half of a horizontal scanning period. Therefore, speaking of the scan signal supplied to the scanning line of a viewing area, when it is not conventionally [ which performs only a full screen display ] different from a configuration at all and performs sector display for this reason, the fault that display grace falls as compared with the case of a full screen display does not generate the display grace in a viewing area, either.

[0055] The details of a <data-line drive circuit>, next the data-line drive circuit 250 are explained. Drawing 9 is the block diagram showing the configuration of this data-line drive circuit 350. In this drawing, the address control circuit 2502 is for generating the line address used for read-out of an indicative data, and it has composition which carries out stepping by the latch pulse LP supplied for every 1 horizontal-scanning period while resetting by the initiation pulse YD to which the line address concerned is supplied by the beginning of one frame. However, if the part I part display-control signal PD 1 serves as L level, the address control circuit 2502 will forbid supply of a line address.

[0056] Indicative-data RAM2504 is a dual port RAM which has a field corresponding to the pixel arranged in 200 line x160 train, and while the indicative data to which a writing side is supplied from a control circuit 400 is written in a predetermined address, the read-out side has the composition that reading appearance of the indicative data of the address specified by the line address is carried out by one line.

[0057] Next, the PWM decoder 2506 is for carrying out Pulse Density Modulation of the data signal according to gradation, and generates the voltage selection signal which chooses the voltage of data signals X1-X160 every data line 212 according to an indicative data from the alternating current driving signal MX, reset-signal RES, and the gradation code pulse GCP. Here, in this operation gestalt, the voltage of the data signal impressed to the data line 212 is binary [ of VDP (positive side data voltage) and VDN (negative side data voltage) ]. Moreover, an indicative data is taken as a triplet (8 gradation) with this operation gestalt.

[0058] First, when the part I part display-control signal PD 1 is H level, the PWM decoder 2506 generates a voltage selection signal so that the voltage level of a data signal may serve as the following relation. That is, the PWM decoder 2506 generates a voltage selection signal so that it may become the relation which the voltage level of a data signal turns into level opposite to the level of the alternating current driving signal MX by reset-signal RES supplied [ the 1st and ] to the beginning of a 1 horizontal scanning period, and reverses [ 2nd ] on the same level as the alternating current driving signal MX in the standup of the gradation code pulse GCP corresponding to an indicative data. The voltage selection signal of the result of having decoded it is indicated to be the binary numeral of the indicative-data signal inputted into the PWM decoder 2506 to drawing 10 . However, if the indicative data of the PWM decoder 2506 is (111) if an indicative data is (000) so that it may be set to reversal level in the alternating current driving signal MX and, the PWM decoder 2506 will generate a voltage selection signal so that the alternating current driving signal MX may serve as the same level.

[0059] Next, when the part I part display-control signal PD 1 is L level, the PWM decoder 2506 generates a voltage selection signal so that the voltage level of a data signal may serve as the following relation. When the part II part display-control signal PD 2 is L level, the PWM decoder 2506 generates a voltage selection signal irrespective of an indicative data so that the voltage level of a data signal may serve as relation reversed for every predetermined period from one side of the positive side data voltage VDP and the negative side data voltage

VDN to another side. On the other hand, when the part II part display-control signal PD 2 is H level, irrespective of the indicative data supplied, the PWM decoder 2506 sets a data value to (000), and generates a voltage selection signal. Now, a selector 2508 actually chooses the voltage directed by the voltage selection signal by the PWM decoder 2506, and supplies it to each of the corresponding data line 212.

[0060] The data signal supplied by <the voltage waveform of a data signal>, next the data-line drive circuit 250 of the above-mentioned configuration is examined. First, for convenience, when [ of explanation ] performing a full screen display, the case where the part I part display-control signal PD 1 is always H level is assumed. In this case, the voltage waveform of a data signal  $X_i$  (integer with which  $i$  fills  $1 \leq i \leq 160$ ) becomes as it is shown in drawing 10. namely, an indicative data -- or (000) (111) if it is except, with the voltage selection signal of the PWM decoder 2506, the voltage level of a data signal  $X_i$  will be reset by the level and reversal level of the alternating current driving signal MX by reset-signal RES supplied to the beginning of 1 horizontal-scanning period, and will be reversed in the standup of the gradation code pulse GCP corresponding to an indicative data by the same level as the alternating current driving signal MX. However, if an indicative data is (000), while the voltage level of a data signal  $X_i$  will be made into reversal level in the alternating current driving signal MX, if an indicative data is (111), it will be made into the same level in the alternating current driving signal MX. For this reason, as a data signal  $X_i$  is shown in drawing in period 1H equivalent to 1 horizontal-scanning period, it turns out that the period used as the period used as the positive side data voltage VDP and the negative side data voltage VDN becomes equal mutually irrespective of an indicative data.

[0061] Moreover, since the alternating current driving signal MX which specifies the polarity of a data signal in the second half of 1 horizontal-scanning period is set as the reversal level of the alternating current driving signal MY which specifies the polarity of a scan signal in this second half, a data signal  $X_i$  is also understood that it becomes a thing corresponding to the polarity of a scan signal.

[0062] Next, the data signal  $X_i$  in the case of performing sector display is examined. Here, sector display as shown in drawing 6 is assumed. in addition, the fixed field which adjoins a viewing area A among the non-display fields B if it is in the following explanation -- the -- the 1 non-display field B1 -- calling -- the [ from the non-display field B ] -- the field which deducted the 1 non-display field B1 -- the -- 2 non-display field B-2 will be called.

[0063] In this case, the part I part display-control signal PD 1 serves as H level in a total of 40 horizontal scanning period when 81 to 120 Motome's scanning line is chosen among one frame, as shown in drawing 11. On the other hand, it is set to L level in a total of 160 horizontal scanning period when the scanning line of one to 80 Motome and 121 to 200 Motome is chosen.

[0064] Among these, since the isopia can be carried out with the full screen display mentioned above, the voltage of a data signal  $X_i$  becomes a thing according to the alternating current driving signal MX and an indicative data in the period when the part I part display-control signal PD 1 serves as H level, i.e., the period when the scanning line contained in a viewing area A is chosen. The field a in drawing 11 shows this. Therefore, since the period which serves as a period used as the positive side data voltage VDP and the negative side data voltage VDN in 1 horizontal-scanning period becomes equal mutually according to such a data signal  $X_i$ , the period used as the period when the part I part display-control signal PD 1 serves as the positive side data voltage VDP also in the period used as H level, and the negative side data voltage VDN becomes equal mutually.

[0065] next, the part I part display-control signal PD 1 -- L level -- it is -- and the part II part display-control signal PD 2 -- L level \*\*\*\* period, the [ i.e., ], -- the period when the scanning line contained in 2 non-display field B-2 is chosen is examined. In the period concerned, irrespective of an indicative data, the voltage of a data signal  $X_i$  is reversed by the PWM decoder 2506 at every [ which divided a total of 140 horizontal scanning period which serves as the L level concerned to another side from either the positive side data voltage VDP or the negative side data voltage VDN by "4" ] 35 horizontal-scanning period 35H, as shown in drawing 11. Also in the period concerned, it turns out that the period used as the period used



as the positive side data voltage VDP and the negative side data voltage VDN becomes equal mutually.

[0066] next, the part I part display-control signal PD 1 -- L level -- it is -- and the part II part display-control signal PD 2 -- H level \*\*\*\* period, the [ i.e., ], -- the period when the scanning line contained to the 1 non-display field B1 is chosen is examined. In the period concerned, as for the voltage of a data signal Xi, the same voltage selection signal as the indicative data of a data value (000) is outputted by the PWM decoder 2506. Consequently, that period is set to 1 horizontal-scanning period 1H in accordance with that to which the data signal Xi reversed the alternating current driving signal MX. The field b shown in drawing 11 shows this.

[0067] now, effective voltage wave Xi' of a data signal Xi is shown in drawing 11 -- as -- the -- although sharply changed in the period corresponding to 2 non-display field -- the -- in the period corresponding to 1 non-display field, it converges on the reference voltage VR which is the intermediate voltage of the positive side data voltage VDP and the negative side data voltage VDN. At the initiation time of a display period, the effective voltage waveform Xi takes reference voltage VR. It enables this to keep the actual value of a data signal Xi being the same as that of the case of a full screen display to reference voltage VR over all display periods also in the case of sector display. Consequently, the image quality in a viewing area A can be raised.

[0068] If it says only from a viewpoint of attaining low-power-ization here, the voltage of the data signal Xi in the period when the scanning line contained to the non-display field B is chosen. Although the configuration made into reference voltage VR is desirable, with this configuration The driver voltage formation circuit 500 (refer to drawing 1) not only needs to form reference voltage VR separately, but Since the number of bits is too many needed also in the voltage selection signal by the PWM decoder 2506 (refer to drawing 9) and the selection range of a selector 2508 spreads further, a configuration is complicated. On the other hand, since the configuration itself is as practically equal as the conventional configuration which performs only a full screen display according to this operation gestalt, complication of a configuration is prevented. Since the data signal Xi in the period when the scanning line of a non-choosing field is moreover chosen is only generated by switching the positive side data voltage VDP or the negative side data voltage VDN for every gap called 30 horizontal-scanning period very longer than the case where the scanning line of a viewing area is chosen, it becomes possible [ stopping low the power consumed by the data-line drive circuit 250 when performing sector display just like the configuration which supplies reference voltage VR ].

[0069] Furthermore, if it is in this operation gestalt when the part I part display-control signal PD 1 is L level, as mentioned above, it has the composition that supply of a line address is forbidden from the address control circuit 2502. Here, since a display is not performed in the period in L level \*\*\*\* period, the part I part display-control signal PD 1 of an indicative data is unnecessary. Therefore, although the configuration that the PWM decoder 2506 disregards the indicative data read from indicative-data RAM in L level \*\*\*\* period is sufficient as the part I part display-control signal PD 1, if supply of a line address is forbidden positively, it will only become possible like this operation gestalt to stop also about the power consumed by read-out of an indicative data.

[0070] Similarly, since a display is not performed in the period in L level \*\*\*\* period, the gradation code pulse GCP has the unnecessary part I part display-control signal PD 1. Therefore, the configuration which disregards the gradation code pulse GCP is also only sufficient for the PWM decoder 2506. However, since the gradation code pulse GCP is the signal which made the RF pulse signal by the RF oscillator circuit 4006 arrange in 1 / 2 horizontal-scanning period according to the wait of the indicative data which shows gradation as mentioned above, the frequency is high for whether your being Haruka as compared with other clock signals and control signals used as 1 / 2 horizontal scanning criteria. For this reason, if the power consumed by originating in wiring capacity etc. is also seen from the whole, it cannot ignore in many cases.

[0071] On the other hand, when the part I part display-control signal PD 1 is L level according



to this operation gestalt, as mentioned above Since the control signal drive circuit 4002 (refer to drawing 3 ) has the composition of stopping generation of the gradation code pulse GCP positively, to the gradation control signal generation circuit 4006 It becomes possible to control also about the power consumed by originating in wiring capacity etc., and the power further consumed by actuation according to the gradation code pulse GCP.

[0072] <Others> Although it was made to reverse a data signal for every 1 horizontal-scanning period in the operation gestalt mentioned above in 10 horizontal-scanning period 10H before and behind 40 horizontal-scanning period 40H corresponding to a viewing area A as shown in drawing 11 This invention is not limited to this and you may make it reverse a data signal for every 1 horizontal-scanning period only in 10 horizontal-scanning period 10H in front of 40 horizontal-scanning period 40H. the [ namely, / which is shown in drawing 6 ] -- the portion (B1u) which adjoins the viewing-area A bottom among the 1 non-display fields B1 -- the -- the portion (B1d) which considers as the 1 non-display field B1, and adjoins the bottom -- the -- you may make it make it contain in 2 non-display field B-2

[0073] the operation gestalt mentioned above -- setting -- the, if it is in the period (the 2nd period) when the scanning line belonging to 2 non-display field B-2 is chosen while reversing the signal level of a data signal for every 35 horizontal-scanning period -- the, although the signal level of a data signal was reversed for every 1 horizontal-scanning period if it was in the period (the 1st period) when the scanning line belonging to the 1 non-display field B1 is chosen This invention reverses a data signal for every 1 horizontal-scanning period in the 1st period, in order to bring the actual value of a data signal close to reference voltage VR. The effective voltage wave amplitude becomes small, so that the reversal period of a data signal is short. Therefore, in order to complete the actual value of a data signal, it is sufficient if the reversal period of the data signal in the 1st period is shorter than the reversal period of the data signal in the 2nd period.

[0074] In the operation gestalt mentioned above, a one terminal pair network mold switching element like TFD is formed for the element substrate 200 of a liquid crystal panel 100 here using transparent insulating substrates, such as glass, and although the pixel 116 was driven and constituted, this invention is not restricted to this. For example, while forming a silicon thin film on the substrate concerned, it is good for this thin film also as a configuration which drives a pixel 116 by TFT (Thin Film Transistor: thin film transistor) in which the source, the drain, and the channel were formed. Moreover, for example, the element substrate 200 is used as a semiconductor substrate, and the driver element of a pixel 116 is not cared about as an insulated gate field effect transistor in which the source, the drain, and the channel were formed on the semiconductor substrate surface concerned. In this case, the pixel electrode 234 will be formed from the reflector which consists of metals, such as aluminum, and will be used as a reflective mold. Moreover, the pixel electrode 234 may be constituted from a reflexivity metal also as a transparent substrate, and the element substrate 101 may be used as a reflective mold.

[0075] However, since either the data line 212 or not only the scanning line 312 but both sides are made to intersect the element substrate 200 and it must form with a transistor with the configuration which drives a pixel 116, since the configuration is more complicated than TFD, the TFT itself is still more disadvantageous in the point that the possibility of wiring short-circuit increases so much, and the point which a manufacture process complicates. Furthermore, although it explained taking the case of the display using liquid crystal as an opto electronics material if it was in the operation gestalt, it is applicable to displays which display according to the electro-optical effect, such as electroluminescence, and a fluorescent indicator tube, a plasma display. That is, \*\*\*\* [ this invention / the liquid crystal display mentioned above and all the electro-optic devices that have a similar configuration ].

[0076] The case where <electronic equipment>, next the display mentioned above are applied to pocket mold electronic equipment is explained. In this case, electronic equipment is mainly constituted in preparation for the source 1000 of a display information output, the display information processing circuit 1002, the drive circuit 1004, a liquid crystal panel 100, and

clock generation circuit 1008 list in a power circuit 1010, as shown in drawing 12 . Among these, the source 1000 of a display information output outputs display information, such as a picture signal of a predetermined format, to the display information processing circuit 1002 based on the clock signal from the clock generation circuit 1008 including memory, such as ROM (Read Only Memory) and RAM (Random Access Memory), the tuning circuit which aligns and outputs storage units, such as an optical disk unit, and a picture signal. Moreover, the display information processing circuit 1002 is a high order configuration including the control circuit 400 in drawing 1 , carries out sequential generation of the digital signal further from the display information inputted based on the clock signal including various well-known processing circuits, such as a serial-parallel conversion circuit, and amplification and a polarity-reversals circuit, a rotation circuit, a gamma correction circuit, a clamping circuit, etc., and outputs it to the drive circuit 1004 with timing signals and control signals, such as a clock signal CLK. Furthermore, the drive circuit 1004 is equivalent to the data-line drive circuit 250 mentioned above, the scanning-line drive circuit 350, a control circuit 400, etc., and includes further the inspection circuit used for inspection in a manufacture process. A power circuit 1010 supplies a predetermined power supply to each circuit, and is the thing of a concept also including the driver voltage formation circuit 500 mentioned above here.

[0077] The example which applied the <cellular phone>, next the display mentioned above to the cellular phone is explained. Drawing 13 is the perspective diagram showing the configuration of this cellular phone. In drawing, a cellular phone 1300 is equipped with a liquid crystal panel 100 with the ear piece 1304 besides two or more manual operation buttons 1302, and a speaker 1306. In this liquid crystal panel 100, while the full screen display which makes all fields a viewing area is performed at the time of arrival or dispatch, sector display which makes a viewing area only the field which awaits and sometimes displays required information, such as field strength, and a number, an alphabetic character, will be performed. Since the power which awaits and is sometimes consumed with a display by this is stopped, it becomes possible to await and to attain protraction of possible time amount.

[0078] In addition, as electronic equipment which applies the display concerning this operation gestalt, although it is necessary to zoom to full screen depending on the case, when other, it is possible to substitute a part only for the display of a field, and a pager besides the strong device of a demand of low-power-izing, for example, the cellular phone mentioned above, a clock, PDA (information terminal for individuals), etc. are suitable. It is applicable to \*\*\*\*\* which corrected, in addition was equipped with the video tape recorder of a liquid crystal television, and a viewfinder mold and a monitor direct viewing type, car navigation equipment, a calculator, a word processor, the workstation, the TV phone, the POS terminal, and the touch panel.

[0079]

[Effect of the Invention] As explained above, after suppressing generating of image quality deterioration in a display according to this invention, it becomes still more possible low-power-ization and to attain simplification of a configuration.

[Brief Description of the Drawings]

[Drawing 1] It is the block diagram showing the electric configuration of the indicating equipment concerning the operation gestalt of this invention.

[Drawing 2] It is the partial fracture perspective diagram showing the configuration of a liquid crystal panel.

[Drawing 3] It is the block diagram showing the configuration of a control circuit.

[Drawing 4] It is the block diagram showing the configuration of a scanning-line drive circuit.

[Drawing 5] It is a timing chart for explaining actuation of a scanning-line drive circuit.

[Drawing 6] In a liquid crystal panel, it is a plan for explaining sector display.

[Drawing 7] It is the timing chart which shows the voltage waveform of a scan signal in the case of sector display.

[Drawing 8] It is the timing chart which shows the voltage waveform of a scan signal in the case of sector display.

[Drawing 9] It is the block diagram showing the configuration of a data-line drive circuit.

[Drawing 10] It is a timing chart for explaining actuation of a data drive circuit.

[Drawing 11] It is the timing chart which shows the voltage waveform of a data signal in the case of sector display.

[Drawing 12] It is the block diagram showing the outline configuration of the electronic equipment which applied the indicating equipment concerning an operation gestalt.

[Drawing 13] It is the perspective diagram showing the configuration of an example slack cellular phone of the electronic equipment which applied this display.

[Drawing 14] It is the timing chart which shows the drive wave of the display panel in the conventional partial drive method.

[Description of Notations]

100 .... Liquid crystal panel

116 .... Pixel

118 .... Liquid crystal layer

200 .... Element substrate

212 .... Data line

220 .... TFD

222 .... The 1st conductor

224 .... Insulating material

226 .... The 2nd conductor

234 .... Pixel electrode

250 .... Data-line drive circuit

300 .... Opposite substrate

312 .... Scanning line

350 .... Scanning-line drive circuit

400 .... Control circuit

500 .... Driver voltage formation circuit

600 .... Power circuit

2504 .... Indicative-data RAM

4006 .... RF oscillator circuit

4008 .... Gradation control signal generation circuit